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This study is based on a university-developed synthetic task, the Team Interactive Decision Exercise for Teams Incorporating Distributed Expertise (TIDE^2). It was predicted that teams of varying gender configuration would differ in communication and coordination patterns, and that these differences would account for significant variation in team process and outcome measures. Gender configuration of teams was manipulated using six unique gender configurations. Predictions relating gender configuration to team effectiveness were made within the theoretical framework of the Multi-level theory (MLT) of team performance (Hollenbeck et al., 1995), where team members have distributed expertise and hierarchical structure. Results demonstrated significant differences in performance among the gender groups, with all-male teams performing most accurately, and teams with a male leader and two female subordinates performing least accurately. This variance in team performance was found to be due to differences in efficiency/effectiveness of information exchange, such that team members of low-performing teams did not acquire requisite information for decision making. In addition, it was demonstrated that measures of gender configuration which have been commonly used provided misleading results, which may explain the conflicting results reported in the past. The MLT theoretical propositions were tested and supported.

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Gender Composition of Tactical Decision Making Teams: Impact on Team Process and Outcome

Introduction

This report describes the data collection and analysis of team performance data of three-member teams composed of various configurations of gender of team members and leaders. Organizations of all types now face the challenges and opportunities inherent in managing an increasingly diverse workforce, as women enter work domains previously dominated by men. This trend is reflected in the inclusion of women in more combat-related military roles, as prohibitions against women in combat situations are lifted. Performance is increasingly reliant on teams composed of individuals differing in expertise and status who must communicate and integrate their perspectives in order to achieve optimal decision making. The influx of women and minorities in the workforce has made these teams more demographically diverse, and this has spurred extensive investigation of workforce diversity and team effectiveness.

Previous studies have investigated relationships between the gender composition of teams and team performance, with conflicting results. Teams of mixed-gender composition have been linked to both positive and negative outcomes (Jackson, May, & Whitney, 1995). For example, while teams of all-male members have performed more effectively than all-female teams on quantitative problem solving tasks, it has also been found that mixed-sex teams performed better than same-sex teams on problem solving tasks (Wood, 1987). In her meta-analysis, Wood noted the conflict in research findings regarding the effect of gender differences in team performance, and encouraged the systematic examination of the impact of gender on group process variables, such as interaction behaviors.

It is argued here that a significant portion of the impact of gender configuration on team performance can be a function of gender differences in communication patterns when the team task requires team members to communicate and strategize to manage their interdependencies and optimize decision making. Previous studies regarding gender differences in communication were reviewed and form the basis for predictions.

A review of the literature supports the notion of gender-based differences in communication and interaction behaviors. Based on a meta-analytic review of gender differences,

Eagley (1995) reported general agreement of stable sex-related differences in social behavior and personality. Eagley reported sex-related differences found by researchers with regard to nonverbal behavior, conformity, susceptibility to influence, empathy, pro-social behavior, aggressive behavior, and leadership behaviors. In general, it has been found that men engage in more task behaviors and women engage in more social facilitative behaviors (Wood, 1987). Wood suggested that the effect of this difference on performance will depend on the nature of the task, and the degree to which task activities (providing opinions, information, etc.) versus facilitative activities (consensus-seeking, seeking inputs) would contribute to successful performance.

This study draws from previous findings to formulate predictions regarding the interaction behaviors and effectiveness of same-sex and mixed-gender 3-person teams, where teammembers have to coordinate information transfer activities, interpret specialized information, and make recommendations to a team leader, who then must assess recommendations and make a final decision. First, previous findings relevant to gender configuration and team performance were reviewed, followed by a review of the literature regarding gender differences in communication. Predictions are then offered regarding differences in communication and coordination in teams differing in gender configuration.

Predictions with regard to the impact of gender configuration and communication patterns on team process and outcome were generated within the context of the multi-level theory (MLT) of team performance (Hollenbeck, Ilgen, Sego, Hedlund, Major, & Phillips, 1995). The multilevel theory provides a systematic approach to the investigation of team performance, allowing the investigation of the impact of variables of interest on team process as well as team outcomes. The theoretical framework enables a richer understanding as to how and why team performance is affected, by tracing the extent to which any differences in performance are due to differences in team processes such as (a) the degree to which team members shared information, (b) the degree to which team members made reliable recommendations, and (c) the degree to which the team leader effectively weighted recommendations from team members. Variables relevant to team performance were investigated through their impact on these processes as well as on overall team performance. Results from this study will contribute to a more well-defined

understanding of the impact of communication effectiveness on team processes, and the impact of gender differences on communication processes.

Background: Gender differences

Hollenbeck, Ilgen, Lepine, & Hedlund (1996) have performed an extensive review of the literature on gender differences as they relate to communication, influence, satisfaction, and performance in decision making teams, soon to be released as a technical report for Armstrong Laboratory, Brooks AFB, TX. This report includes conclusions and predictions from their effort.

Research on gender differences have recently experienced a surge of interest and effort. T Hollenbeck et al. (1996) identify two streams of research having substantial and complementary explanation for findings of gender differences in general. One approach, evolutionary psychology, emphasizes the role of evolution in producing gender differences to enable higher performance in sex-differentiated roles. The primitive hunter-gatherer societies, prevalent for 2,000,000 years, were typically segregated into male hunter roles and female gatherer roles. Thus, the finding that men have higher spatial rotation abilities are thought to be a function of the higher need for this ability for skilled hunting. The finding that women have higher spatial memory abilities has also been explained using this approach, as resulting for the higher need for spatial memory when remembering locations from which to gather desired items (Hollenbeck et al., 1996). Differences in other characteristics, such as aggressiveness and nurturing behaviors, have also been attributed to our genetic heritage.

The second approach, social role theory, emphasizes the role of social structures and expectations of significant others in the formulation of gender-specific stereotype preferences and behaviors. This theory ascribes to women communal characteristics such as expressive behavior, selflessness, and nurturance. Men are characterized with agental characteristics, such as competitiveness, assertiveness, and risk-taking. The assumption within this theory is that many gender differences are a product of social structures and can therefore be altered by changing the social structures.

Gender differences have been demonstrated; however, it is not known whether gender differences in communication patterns are a result of genetic history or social roles, or an interaction of the two. While interesting, it is not the purpose of this report to investigate causes

of gender differences; rather, this study focuses on identification of the effects of gender differences within a team task context.

In this study, gender differences within teams are expected to effect performance in decision making teams. Gender differences in communication style are expected to affect team performance in tasks where teammembers must communicate and coordinate information exchange. These differences may be further enhanced by gender bias, if teammembers of one gender do not communicate as completely to members of the other gender, or if recommendations from one gender are less likely to be considered in the decision making process.

Framework for assessing impact of gender differences. Hollenbeck et al. also provided a useful framework for the interpretation of research findings on gender differences and team performance, by distinguishing studies at different levels of analysis. Findings are more likely to be consistent when these distinctions are kept. Examples of each category of research are provided in Table 1. Detailed descriptions of findings in these general categories are provided by Hollenbeck et al. (1996).

Table 1. Levels of Analysis in Research on Gender Differences and Team Performance

	Individual: Gender differences as Independent variable	**Team: Gender configuration as Independent variable**
Team-level performance as Dependent variable	Ex: Gender differences as affecting team communication effectiveness	Ex: Gender configuration as affecting team decision making accuracy
Group-level behaviors as Dependent variable	Ex: Gender differences as affecting team morale	Ex: Gender configuration as affecting formation of coalitions
Dyad-level performance as Dependent variable	Ex: Gender differences as affecting member-member information exchange	Ex: Gender configuration as affecting leader-member interactions/perceptions
Individual-level Dependent variables	Ex: Gender differences as affecting Ind. performance, abilities or attitudes	Ex: Gender configuration as affecting amount of influence an individual demonstrates

Gender Configuration and Team Performance

It has been found that gender diversity in general has often been associated with lower effectiveness in team settings. Diversity has been found to be associated with lower cohesiveness and more negative attitudes (Jackson, 1992). Teams composed of members who are demographically diverse have also been described as having fewer communications and segregated informal communication networks. On the other hand, in a comprehensive review of the literature, Wood (1987) concluded that mixed-gender teams have outperformed same-gender teams and all-male teams outperformed all-female teams when the task was masculine in type (Wood, 1987). Additional studies reviewed by Hollenbeck et al. also provided mixed results.

One explanation for these inconsistent results is provided by Hollenbeck et al., who pointed out that gender configuration has been poorly specified and defined in previous studies. Studies have categorized teams as same-gender versus mixed-gender. This would place all-male teams in the same category as all-female teams, thus leading to confusing findings if there are differences between all-male and all-female teams. Mixed-gender teams have also been distinguished by Kantner (1977), who compared teams with equal numbers of men and women versus teams where a single person represents a minority gender. Even so, this minority-status configuration combines teams with a single female member and teams with a single male member. Subsequent research suggests this difference is important (Hollenbeck et al, 1996). A further distinction can be made depending on whether the team leader is male or female. The behavior of a single female in a team situation can be expected to differ depending on whether she is a subordinate or the team leader. Subsequent investigations should distinguish among these types of gender configuration. In this study, six unique configurations of gender mix are investigated.

Previous studies are not consistent with regard to gender configuration and team performance, thus predictions based upon empirical findings would be difficult to defend. Even if results were consistent, there would still remain the need to identify the root cause of performance differences. The existence of conflicting results further underlines the importance of systematic theory-based predictions which (a) distinguish among the different types of gender configuration and (b) trace the impact of gender differences on team communication and decision making processes as well as team performance.

Gender Differences in Communication

Research on gender differences in communication include findings regarding gender differences in communication in general, such as everyday conversation. These differences are generally consistent with stereotypes of feminine and masculine behavior. Women are seen to be more nurturing, emotionally expressive, and having more interpersonal sensitivity, whereas men are seen to be more assertive, independent, and impersonal. These differences have been upheld to some degree (Wood, 1987; Eagley, 1995), yet there is much overlap between the sexes, and much is unknown as to the source of these differences. From the standpoint of social role theory, team members may conform to traditional gender role behavior, especially in a mixed-sex team and particularly when no other status cues are available.

In her meta-analysis of sex differences in group performance, Wood (1987) suggested that differences between teams of differing gender may be due in part to differences in communication patterns. Wood described several studies where male team members appear more likely to display task behaviors such as providing suggestions, whereas female members were more likely to display social behaviors such as agreement, facilitating input from others, and friendliness. The impact of these differences on team performance may depend on the nature of the team task, the degree to which social activities facilitate or impede performance, and the degree to which the setting encourages gender-role behavior. For example, a single female in an all-male team may facilitate the expression of traditional gender behaviors on the part of both males and the female, particularly before other indicators of status, due to position or expertise, are apparent.

Gender differences in communication and team member status. Status has been suggested as an additional reason for gender differences in communication and performance in teams. The expectations of self and others can determine the status of team members. Differences in status has been suggested as an explanatory mechanism for gender differences in communication (Wood, 1987), in that men's propensity for task behaviors may stem from initial perception of higher status along with a striving to maintain or increase status. Lower status members were described as contributing more facilitative behaviors as opposed to task activities. This finding can be placed within a general trend regarding differences in perceptions of power, and is a possible source of differences in communication patterns between women and men.

Status within a team has been shown to affect communication patterns. High-status members tended to speak more often, criticize more often, be more persuasive, and be evaluated by other team members more highly (Jackson et al. 1995; Levine & Moreland, 1990). Differences in status (rank) were found to be a source of ineffective communications (Kanki & Foushee, 1989; Foushee, 1984). Senior officers were not as likely to solicit or incorporate the input from junior officers and junior officers were likely to be passive in their communications.

While it is debatable whether gender affects perceptions of status per se, the type of predicted effects are similar. In addition, one can investigate interactions between indicators of status and gender. If effects are additive, it is reasonable to expect that high-status males would be most likely to demonstrate task oriented, assertive, and influential behaviors. This could have a positive effect if the individual is also high-ability for the task, but can be detrimental if not. On the other hand, low-status females would be most likely to demonstrate facilitative, passive, and agreeable behaviors. These behaviors can also have a positive effect when associated with high ability, especially in situations where consensus among team members is required. In that situation the persuasiveness of expertise would be paired with a facilitative approach to consensus.

In the military, rank is an explicit indicator of status, which has been demonstrated to influence communication patterns. As many previously male-oriented military specialties are becoming open to women as job opportunities, military teams are increasingly likely to be gender-diverse, and women in these teams are likely to be less experienced. It is important to disentangle effects of rank, expertise, and gender when analyzing differences in communication and performance in these teams. In this study, based on novice subjects performing a synthetic team task, the only manipulation of status is that of team leader Vs team member. Follow-up study using AWACS weapons directors in a realistic command and control simulation will further investigate the role of rank and gender.

Gender configuration and communication patterns. Empirical investigations and theory-based predictions regarding gender differences in communications and team performance have often been at the individual level of analysis, that is, differences have been attributed to differences in gender, which would be consistent regardless of particular gender configurations. For example, female communication style would be similar in all-female teams or teams with a single

female. Gender-based distinctions in communication style (e.g. women are more facilitative and men are more assertive), were predicted to occur whether the team was comprised of all women, all men, or any mix of gender.

Another approach to investigating contextual effects of gender configuration compares all male teams with mixed-gender and/or all-female teams. Mixed gender teams included all configurations of gender mix, such that teams with equal numbers of men and women would be categorized with teams with a single minority-gender team member. Kantner (1977) distinguished the minority-status configuration within mixed-gender teams, such that predictions differ between teams with equal representation of gender and teams with a single minority member.

The approaches described above may be insufficient to make predictions regarding differences in communication patterns. As Hollenbeck (1996, in press) points out, it is likely that communication patterns are likely to differ between teams where the minority-status member is male, versus teams where the minority-status member is female. It is also likely to make a difference whether the minority status member is a subordinate or the team leader. For example, a single female within a team is likely to experience different communication dynamics depending on whether she is a subordinate or the team leader. The status and role expectations associated with the leader position is likely to ameliorate gender-based differences on the part of the female leader and the male subordinates. On the other hand, when the minority female is a subordinate, it is expected that gender-based differences in communication behaviors will be more likely to be expressed.

Theoretical Approach

Boundary Condition for Predictions: Team Task

Before predictions are offered for the impact of gender differences and/or gender configuration on team performance, one should consider the nature of the team task to be performed, and specify the manner in which gender-based variables will impact team performance outcomes. For example, much of the previous research on team decision processes have focused on consensus decision tasks, where each team member has an equal vote in the decision process (Davis, 1992). Team decision processes are likely to differ when the decision task has different

characteristics, such as the nature of the information to be considered (objective, subjective), the inclusion of subjective issues such as ethics or values, the level and diversity of expertise required in the task, and the manner in which final decisions are made (e.g. consensus, negotiation, arbitration).

In this study, the team task included (a) assessment of objective cues indicating threat of unknown aircraft by individuals trained to (b) have distributed expertise with regard to accurately interpreting cue levels and interactions, (c) perform information transfer activities among team members, (d) recommend actions as to level of threat and course of action, to (e) a team leader who makes the final decision. Research participants were trained to perform a computer-administered team decision making task modeling a simplified military threat assessment decision exercise.

Gender is expected to influence performance in this type of task through effects on communication effectiveness. In this task, team members could see each other but did not speak to each other. Instead, they communicated through the computer, using automatic information transfer functions and text messages. Differences in communication style may not be as salient within this context. Even so, measures based on information transfer and text messages can indicate the degree to which requests for information are responded to, and the degree to which the team attains efficient information transfer where requests are not necessary. Text messages can also be examined for differences in task orientation, strategy formulation, expressions of encouragement, and other categories of communication behavior.

Also, because this task is based on leader decisions, there is an additional way in which gender differences can influence performance. In this task, gender configuration can influence performance through the manner in which the team leader weights the recommendations provided by subordinates. The consideration given to a team member's judgment may be a function of the sex of the leader, the sex of the team member, and whether the leader or member was a minority gender. For example, different weighting schemes are expected in a team with a male leader and a single female team member, compared to a team with a female leader and a single male team member, or an all-male team. While this study is focused on differences in communication, we shall also investigate the degree to which gender affects which recommendations are more highly weighted by the team leader.

Multi-Level Theory of Team Performance

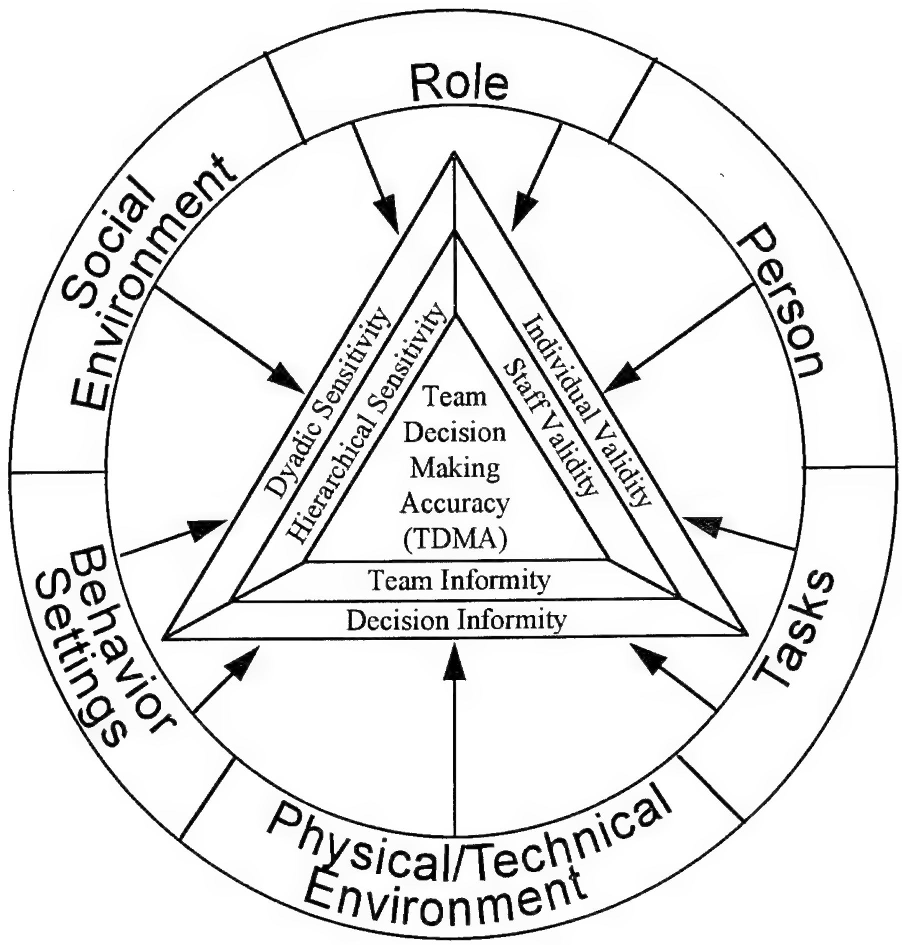
Predictions within this study are made within the Multi-Level Theory (MLT) framework, which provides a systematic approach to prediction and analysis of team performance data. First, propositions within the MLT theory are reviewed. Hypotheses were then formulated to verify these propositions. According to this theory, the core constructs mediate the effect of extraneous variables on team performance. This will be tested with regard to the impact of communication and coordination indices within the MLT framework. Finally, predictions regarding gender differences and gender configuration are added within the context of this framework.

The multi-level theory of team performance. Measures of team processes within this study include the three core constructs specified within the MLT theoretical framework as mediating team performance (Hollenbeck et al, 1995; Ilgen, Major, Hollenbeck & Sego, 1995). Very simply, the MLT framework specifies three factors through which other variables would impact performance. These variables can be generally described as (a) the degree to which individuals and teams are well informed about the decision (team informity), (b) leader sensitivity to subordinate expertise (dyadic and hierarchical sensitivity), and (c) accuracy of team member judgments (staff validity; the extent to which team member judgments correlated with the correct judgments).

The theory can be represented by a simplex diagram (see Figure 1), where the team-level core variables are most proximal to team decision accuracy, followed by the individual-level measures of core variables. Variables in the outer ring area represent the variety of factors that could possibly affect team performance, such as job task characteristics, individual knowledge and skills, and the social environment. These variables are expected to impact team performance through their effect on one or more of the three core constructs. Thus, the impact of any variable on team performance can be traced to effects on team informity (e.g. task characteristics can affect the degree to which team members easily obtain required information), staff validity (e.g. training would affect validity of individual decisions), and/or hierarchical sensitivity (e.g. biases that a leader may have may affect the degree to which he/she effectively weights information and recommendations provided by team members).

Figure 1. Overview of the multilevel theory of hierarchical team decision making

(Ilgen & Hollenbeck, 1994)



Communication, coordination, and team effectiveness. Gender configuration is expected to impact team performance due to effects on communication effectiveness. This assumes that measures of communication / coordination efficiency and effectiveness will impact team effectiveness. MLT theory predicts that these variables will be mediated by staff validity, team informity and hierarchical sensitivity.

Communication effectiveness and coordination have been empirically related to team performance. Communications have been described as mediating team performance in aircraft cockpit crews (Foushee, 1984; Kanki & Foushee, 1989). An interesting finding by Kanki and

Foushee was that two-person dyads which were supposed to represent the "high fatigue" condition performed better than the "low fatigue" dyads. This was explained as due to the fact that the high fatigue conditions had members who had recently flown together and were reporting for the study straight off a mission together, while the low fatigue members were rested, but not familiar with each other. Communications differed between the two groups, such that the high fatigue/familiarity teams had more effective communications (fewer utterances, more task-related utterances. The fact that communication effectiveness had more of an effect than fatigue illustrates the importance of team processes and the need to understand the knowledge, skills, and characteristics that underlie effective team performance.

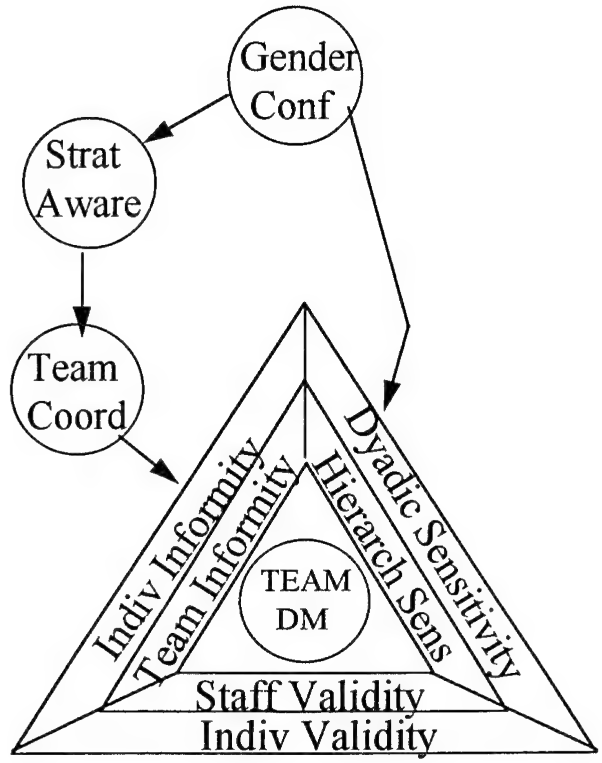
There have been several other studies linking conceptualizations of communication and coordination to performance. These studies are reviewed and discussed in detail by McIntire & Salas (1995) Salas et al. (1992), and by Prince, Chidester, Bowers, & Cannon-Bowers (1992). Relationships between measures of team communication, coordination, and team performance have been established.

In this study, the team process measures will include measures of team communication and coordination performance in a team task that requires team members to strategize in order to coordinate information efficiently. This team task required team members to (a) provide and procure information and (b) accurately interpret that information. Measures of knowledge regarding team member needs and capabilities are predicted to affect team performance through their relationships with team implicit coordination.

Team informity is expected to be affected by strategic awareness and implicit coordination. Strategic awareness is defined as team member knowledge of the capabilities and interdependencies among team members. In this task, the team members must provide each other with information necessary for each team member to make accurate judgments. Team members must find out who has the information he/she needs, and who needs the information that they already possess. Once they ascertain the needs of the other team members, they must devise a method to efficiently provide each team member with their required information. The measure of implicit coordination assesses the degree to which this information is shared with minimal communication activity, minimizing redundancy of action. Thus, as demonstrated in Figure 2, strategic awareness is expected to relate to implicit coordination, which in turn is expected to

relate to the degree to which team members receive their requisite information (team informity).

Figure 2: Predicted Relationships between Gender Configuration and Team Variables



Predictions

It is expected that differences in gender configuration will result in differences in team decision accuracy. More specifically, it is expected that gender configuration will affect team strategic awareness and communication patterns, which are expected to affect MLT core constructs of team informity, staff validity, and hierarchical sensitivity. Hypotheses are offered with regard to:

1. The impact of gender-related variables on team performance.
2. The impact of gender-related variables on MLT core constructs.
3. The impact of gender-related variables on communication and strategic awareness.
4. The impact of MLT core constructs on team performance.
5. Mediation of team performance by MLT core constructs.

Hypothesis 1. Differences in gender configuration will be associated with differences in team performance. Teams differing in gender configuration are expected to demonstrate differences in overall team decision accuracy. Prior research findings are conflicting. One possible explanation is the use of broad descriptors of gender configuration in previous studies which could prevent the identification of performance differences due to the specific configuration of the team. The following planned comparisons were based on previous findings to investigate the degree to which previous findings are replicated.

H1a. All-male teams would perform more accurately than all-female teams. In general, all-male members have performed more effectively than all-female teams on quantitative tasks (Wood, 1987) and are more task oriented (Jackson et al. 1995). While women have been associated with higher social / facilitative skills, this task does not require agreement or negotiation. Team members provide the team leader with a recommendation and the team leader is responsible for the final team decision.

H1b. All-male teams will perform more accurately than teams with a single female. This prediction is based on Kantner's (1977) discussion of minority-status configuration within mixed gender teams. However, this effect was expected only when the minority member is female. A team with a single male was not expected to be negatively affected by minority status.

H1c. All-female teams would perform more accurately than mixed-gender teams. This proposition was based on the finding that diversity in general has often been associated with lower effectiveness (Jackson, 1992). All-female teams are expected to have similar communication styles and minimal bias among team members.

H1d. All-female teams will perform more accurately than teams with a single female. This expectation follows from 1b and 1c.

H1e. Teams with a single male subordinate will perform more accurately than teams with a single female subordinate. This proposition tests Kantner's assertion that minority status per se would have a negative effect. In contrast, this study predicts the minority status effect is limited to when the minority is female.

H1f. Teams with a single male as leader will perform more accurately than teams with a single female as leader. This proposition also follows from previous results regarding single women in teams, but disputes Kantner's explanation of minority status per se as explaining

results. Single male leaders are expected to perform better in this task, due to the congruence of task demand and previous findings regarding men in task oriented roles (not requiring facilitation, negotiation, or longterm relations).

Hypothesis 2. Differences in gender configuration will be associated with differences in MLT core constructs. The multilevel theory of team performance states that the impact of any variable on team decision accuracy can be accounted for by the impact of that variable on three core constructs: (a) team informity, (b) staff validity, and (c) hierarchical sensitivity (Hollenbeck et al., 1995). The following hypotheses relate gender configuration to these core constructs.

H2a. Differences in gender configuration will be associated with differences in team informity. The categorical variable representing the 6 gender configurations were expected to account for significant variance in team informity. Consistent with MLT theory, it is expected that gender configuration categories associated with higher team performance will demonstrate higher team informity than gender configuration categories associated with poor team performance.

H2b. Differences in gender configuration will be associated with differences in staff validity. The categorical variable representing the 6 gender configurations were expected to account for significant variance in staff validity. Consistent with MLT theory, it is expected that gender configuration categories associated with higher team performance will demonstrate higher staff validity than gender configuration categories associated with poor team performance.

H2c. Differences in gender configuration will be associated with differences in hierarchical sensitivity. The categorical variable representing the 6 gender configurations were expected to account for significant variance in team hierarchical sensitivity. It is expected that gender configuration categories associated with higher team performance will demonstrate more effective hierarchical sensitivity than gender configuration categories associated with poor team performance.

Hypothesis 3. Differences in gender configuration will be associated with differences in implicit coordination and strategic awareness.

H3a. The categorical variable representing the 6 gender configurations were expected to account for significant variance in implicit coordination. Gender configuration categories

associated with high team performance are expected to demonstrate more effective implicit coordination than gender configuration categories associated with poor team performance.

H3b. Differences in gender configuration will be associated with differences in strategic awareness. The categorical variable representing the 6 gender configurations were expected to account for significant variance in strategic awareness. Gender configuration categories associated with high team performance are expected to demonstrate a higher degree of strategic awareness than gender configuration categories associated with poor team performance.

Hypothesis 4. Each of the MLT core constructs will contribute to the prediction of team performance. This hypothesis test propositions offered by Hollenbeck (1995) regarding the Multilevel theory.

H4a. All else constant, team decision making accuracy will be higher for teams which are high in team informity than for teams which are low in team informity.

H4b. All else constant, team decision making accuracy will be higher for teams which are high in staff validity than for teams which are low in staff validity.

H4c. All else constant, team decision making accuracy will be higher for teams which are high in hierarchical sensitivity than for teams which are low in hierarchical sensitivity.

The following hypotheses tests the proposition offered by Hollenbeck et al., (1995) regarding the multi-level theory of team performance, with regard to the mediation of team performance through the MLT core constructs.

Hypothesis 5. The effect of noncore variables (gender configuration, implicit coordination, strategic awareness) will be mediated by the core constructs. Staff validity, team informity, and hierarchical sensitivity are expected to predict unique variance in team decision effectiveness. This will be tested using multiple regression to ascertain the main effects of these three variables. It was predicted that each MLT core variable will add significantly to the overall R2, and that addition of noncore variables will not contribute significantly to the R2.

H5a. The effect of gender configuration on team decision making accuracy will be mediated by MLT core constructs.

H5b. The effect of implicit coordination on team decision making accuracy will be mediated by MLT core constructs. Implicit coordination is expected to be related to team informity, and to a lesser degree, staff validity. Teams which are efficient in their information

transfer activities are expected to be more highly informed than those which are not efficient. Teams that are more highly informed are expected to provide more reliable recommendations, as reflected by staff validity.

H5c. The effect of strategic awareness on team decision making accuracy will be mediated by MLT core constructs.

Method

Research Design

Primary variables of interest in this study were gender-related. Subjects were assigned to one of six gender configurations of three-person teams comprised of two subordinates and a team leader. The six configurations account for every possible configuration if one varies the proportion of women in the team (from 0 to 3) and the sex of the leader. All teams were trained in the same way to perform identical tasks. Other variables related to gender include categorization of teams according to the number of women in each team, gender diversity (comparisons of same-sex versus mixed-sex groups), and gender of the team leader.

This investigation focused on assessing the extent to which team-level construct of gender configuration affects team decision accuracy and team processes. Process variables included measures such as (a) team informity, the extent to which all team members attained the information they needed, (b) staff validity, the extent to which subordinate recommendations were reliable, and (c) hierarchical sensitivity, the degree to which the team leader effectively weighted the recommendations of subordinates.

In addition, teams of different gender configuration were compared for differences in communication and coordination patterns. Dependent measures were derived from objective indices of team member actions, such as the proportion of required information received by each team member for each decision, the degree to which requests for information were responded to, and the accuracy of each team member's judgment.

Research participants. 120 research participants were recruited from a local temporary hiring agency. Criteria for selection as a participant included college student status (preferred) or

college experience, 18-30 yrs old, with experience in using a computer with a mouse. The use of a hiring agency solved the problem of scheduling, which can be a problem in team research.

Assignment to gender configuration condition. One hundred and twenty individuals were trained to perform the TIDE^2 task. They were assigned to one of 6 gender configuration categories in the following manner: First, teams were generated that had either 3, 2, 1, or 0 females. This provides all possible configurations of gender within 3-person teams, when gender of the leader is also crossed (see Table 2).

Table 2. Gender Configuration of Teams

# Females in team	Male leader	Female leader
0	6 teams	
1	6 teams	6 teams
2	7 teams	6 teams
3		7 teams

Of the mixed gender teams, 1/2 were led by females, the other by males, to form the following six cells: (a) all female team (female leader), (b) two females (female leader), (d) two females (male leader), (e) one female (female leader), (f) one female (male leader), and (g) all male (male leader). Two teams had to be discarded due to equipment failure, thus analyses were based on 38 teams, with at least 6 teams of each gender configuration.

TIDE^2 Synthetic Team Task

This study investigates team performance on a synthetic task developed by university faculty sponsored by the Office of Naval Research. This task, the Team Interactive Decision Exercise for Teams Incorporating Distributed Expertise (TIDE^2), enables a tightly controlled study of team processes within an interdependent team decision making task (see Hollenbeck et all, 1995; Ilgen & Hollenbeck, 1993, for in-depth description and rationale). TIDE^2 was developed to investigate decision processes and team performance dynamics and provide clear-cut measures of communication, coordination, and team effectiveness from objective embedded performance measures. Every action performed by the team members is captured in a datafile. In

addition TIDE^2 generates more refined datafiles, comprised of measures calculated from the raw data file. This enables the efficient and reliable investigation of team performance, without depending on observer ratings or the labor-intensive coding of videotape (Ilgen & Hollenbeck, 1993).

The TIDE^2 task captures nearly all keystrokes made by team members, along with the time stamp for each action. Thus, the data base created by the TIDE^2 software enables the analysis of performance data which can be very finely detailed. In this study, all communication actions were captured, along with the time each action was taken, the sender of the communication action, the content of the communication, and the recipient of the communication. In addition, for information transmission activities, such as requests for information, the TIDE^2 software captured more dynamic, dyad-based sequences of behaviors. For example, indices of efficiency were automatically generated depending on the response to a request for information, such as whether the request was ignored or acted upon.

For this study, the TIDE^2 was configured for three-person teams who were told they were to play the roles of a command-and-control team tasked to protect a friendly military base from hostile aircraft. They were trained to assess the threat level of hypothetical incoming aircraft by interpreting information related to the unknown aircraft. Information cues were developed to reflect information consistent with Air Force Airborne Warning and Control System (AWACS) terminology. Cues included characteristics such as speed, direction, location, type of radar, altitude, and rate of altitude change. Each cue had three levels of threat, from no threat to high threat. To make the assessment of threat more complex, the total threat of a given aircraft is not necessarily reflected by averaging across the threat levels of each cue. Instead, cues interacted such that the interpretation of one cue depended on the values of two other cues.

<u>Creation of distributed expertise</u>. All team members were provided with general information on each cue (see Table 3). The information described the nine cues which must be considered, and the range of values for each. They were also told which cues interacted in determining threat level.

Table 3. General Characteristics Of Airborne Aircraft

Information cues	Definition	Range
RANGE	Distance from your base operations. In general, aircraft that are **closer** are more threatening	0 - 600
ALTITUDE	# feet aircraft is above ground In general, aircraft that are **low** in altitude are more threatening	100 - 99,000
RADAR CROSS SECTION	Estimated size In general, **smaller** aircraft are more threatening	0 - 12
CORRIDOR STATUS	Miles from center of civilian corridor In general, aircraft **far outside** the civilian corridor are more threatening	0 - 25
ELECTRONIC SECURITY MEASURE (ESM)	Indicates threat of radar signals In general, aircraft with **high ESM values** are more threatening	0 - 999
# OF AIRCRAFT	Estimated number of aircraft In general, a **higher number of aircraft** is more threatening	1 - 20
HEADING CROSSING ANGLE (HCA)	Indicates direction of aircraft In general, the **higher the HCA**, the more directly the aircraft is headed toward the base, which is more threatening.	0 - 180
RATE OF ALTITUDE CHANGE (RATE^ALT)	# feet/minute ascending or descending In general, the **higher the rate of altitude** change the more threatening	0 - 10,000
SPEED	Miles per hour In general, the **faster** the aircraft the more threatening	0 - 800

In addition, each member was provided with detailed information on how to interpret particular subsets of interacting cues, to establish team members with expertise in different areas. For each set of three cues, interpretation of threat was based on interactions among the three cues, making interpretation more difficult than a summation or average of the three cues. For example, range (distance from home base),corridor status (whether the aircraft is within, outside, or far outside the route assigned to civilian aircraft), and number of aircraft comprised one set of three cues. If one of the three cues was safe, the sum threat of all three cues was safe regardless of the threat level of the other three cues. Team members were given only general information

about the other six cues. Thus, a correct assessment of the entire aircraft can be attained if team members accurately interpret their assigned cues, and the team leader gives equal weight to the assessments provided by each team member.

Creation of interdependence and need for communication. In this study, communications and coordination among team members were of interest, therefore the $TIDE^2$ task was configured to necessitate the exchange of information among the team members. While each of the team members could measure five cues without the assistance of other team members, they could only measure one of the three cues they needed. They had to get the other two cues from either of the other two team members (see Table 4). The other four cues measured by each team member were needed by other team members.

Table 4. Team Member Capabilities And Needs

ALPHA	BRAVO	CHARLIE
Can measure:		
Range	Altitude	Radar C.S.
HCA	Corridor Status	Corridor Status
Speed	# Aircraft	# Aircraft
ESM	ESM	HCA
Rate^Alt	Rate^Alt	Speed
Is Responsible For (Needs):		
Range/Corridor St/# Aircraft	Altitude/HCA/Speed	Radar C.S./ESM/Rate^Alt

Most efficient: each member sends two pieces and receives two pieces of information.

Team members had to communicate with other team members in order to find who had the information they needed, and to send and receive information to each other. Team members could request and send aircraft information to other team members using automated procedures. In addition they may also communicate with each other via text messages, which allows discussion of task related issues such as information coordination strategies, cue threat interpretation, etc. Finally, the cues were distributed across team members such that each team member could get all of their required information from either of the other two team members.

In this way, two members can get their required information by interacting mainly with each other, and ignore the requests of the third member.

In addition, if team members wished to correctly interpret the other four cues that they could measure, they would have to be taught how to interpret those cues from the other team members. Each team member had specialized knowledge that enables more accurate interpretation of their assigned three cues. Thus, there were several task-related reasons for communication: (a) devising a strategy to coordinate efficient information transfer, (b) providing required information, and (c) sharing expertise in how to interpret information outside team members' specialty.

Feedback of performance. Team members were presented with feedback on their decision accuracy immediately after each decision was made. The feedback screen also provided the performance history (total number of scored points; average score per decision) of the team up to that point.

Measures

Most of the measures of team processes and outcomes were embedded within the $TIDE^2$ scenario and relate to theoretical constructs in an existing paradigm of team distributed decision making (See Hollenbeck et al, 1995 for detailed description of theory, constructs, and measures). These include measures at different levels of analysis: (a) decision (i.e. decision informity, the amount of information held by team members regarding one decision event), (b) individual (i.e. individual validity, informity, and decision accuracy), (c) dyadic (i.e. dyadic sensitivity, the degree to which the team leader effectively weights the recommendations of a given team member), and (d) team (i.e. team informity, hierarchical sensitivity, staff validity, team decision accuracy). Remaining measures were assessed through questionnaires administered after the $TIDE^2$ task was completed.

Team Informity. This was conceptualized as being the extent to which team members received the information required for their expertise (Hollenbeck et al, 1995). It was based on the average number of information cues received by each team member that was required by that team member. Each team member needed 3 pieces of information for each decision. If each team

member received all information she/he required, for one decision, team informity would be maximal, in this case with a value of 9. Team informity (I) can be expressed as:

$$I_j = \sum_{i=1}^{k} a_{ij} / k a_{it},$$

where a_{ij} is the number of attributes a, known on decision object i by members of Team j; a_{it} is the total number of attributes that could possibly be known on decision object i; and k equals the number of decisions made by the team (Hollenbeck, et al., 1995).

Staff validity. This was the average correlation between team member recommendations provided to the team leader with the correct score for each aircraft. This reflects the degree to which team members provided reliable recommendations to the leader. Expressed quantitatively,

$$SV = \sum_{m}^{n_j} | r_{mj} | / n_j ,$$

where r_{mj} is the predictive validity of staff member m on Team j, and n_j is the number of staff members in Team j (Hollenbeck et al, 1995).

Hierarchical sensitivity. This measure reflects the sensitivity the team leader has as to the competence of other team members, and the degree to which he/she effectively weights the judgments of the other team members. First one identifies the ideal weights that should have been used by the leader, given the recommendations he or she received. This can be done by regressing the correct decision with the subordinate recommendations for each decision, resulting in a set of weights that reflects how the subordinate judgments should have been weighted. Then one performs the same regression using the leader's judgment as the criterion, which results in the set of weights reflecting the leader's weighting of subordinate judgment. If the leader weighted the recommendations in an ideal manner, there would be little if any difference between the leader weights and the ideal weights Hierarchical sensitivity is the average difference, expressed in absolute terms, between the b weight for each staff member's judgment in predicting the criterion and the b weight for each staff member's judgment in predicting the team decision made by the leader.

$$HS = \sum_{m=1}^{n_j} |B_{mt} - B_{mi}| / n_j,$$

Where B_{mt} is the b weight for team member m's judgment in predicting the "true score" on the decision object, B_{mi} is the b weight for team member m's judgment in predicting the leader's decision, and n_j is the number of staff members (and hierarchical dyads) in the team (Hollenbeck et al., 1995). If there were large differences in the weights, the leader was not weighting the information in an effective manner. For example if there were an incompetent member who consistently gave wrong judgments, the regression against the correct answer would result in a small weight to that member. If however the leader tended to agree with the incompetent member, then that regression would result in a larger weight for the prediction of leader decisions. The smaller the differences between ideal and leader weights, the higher the hierarchical sensitivity (Hollenbeck et al, 1995).

Communication behaviors: Automated information transfer functions. $TIDE^2$ allows the transfer of aircraft-related communications through automated functions which require no speech or typing. Using a computer mouse on pull-down menus, team members can query each other (ask for particular information to be transmitted to them), transmit information, and receive information. After the task is complete, $TIDE^2$ provides descriptive statistics of these behaviors for each dyad and for the team as a whole. For example, given a three member team (comprised of Alpha, Bravo, and Charlie), for each decision, one will have the number of times Alpha queried Bravo, Alpha queried Charlie, Bravo queried Alpha, Bravo queried Charlie, Charlie queried Alpha, and Charlie queried Bravo. Categories were as follows.

Query - When one team member asked for specific information from another.

Receive- When one team member received a query, transmit, or text message.

Transmit- When one team member transmitted information to another.

Message- When one team member sent a text message to another.

Learns - A completed 4-action loop: a query was sent, was received; the receiver transmitted the requested information, the information was received by the team member who sent the query.

Lecture - A 2-action loop, where information is transmitted (without the query) and received by the recipient.

Indices of communication inefficiency. The TIDE^2 program generates measures of communication efficiency through measures reflecting the degree to which a query results in the requester actually receiving the information requested. These were:

Slight - Where a query was sent but was not "received" by the recipient.

Unresponse- Where a query was sent, and was received by the recipient, but was not responded to (The query asks for information, this information was not sent).

Forget - Where a query was sent, and was received, and was responded to (the recipient sent the information) but the response was not received.

Implicit Coordination. One measure of communication effectiveness assessed the degree of implicit coordination among the team members. This measure was developed by Hollenbeck et al. (in press), and was based on counts of "wasted motions." Wasted motions include any action taken that does not actually ship information to another team member. They were embedded in the measures of slights, unresponses, forgets, and learns. A slight includes one wasted motion because a query was sent, but not received. Thus, the query was a wasted motion in this action. An unresponse includes two wasted motions, because a query was sent (one wasted motion) and it was received (second wasted motion) and no further action was taken. A forget was three wasted motions, because a query was sent, received, and information was transmitted, but not received -- three actions were taken with no information being shipped. A learn was considered to have two wasted motions, the query and the receive of the query, because if the team members were highly efficient, they would not need to query each other, but simply send the information that was required without being asked. The measure of implicit coordination was achieved by using the following formula:

[# slights (1) + #unresponses (2) + # forgets (3) + # learns (2)]

This was based on the rationale that when team members were implicitly coordinated, they will send information required by team members without being asked. The requirement for this implicit coordination was that team members know what other team members need. Therefore in a team that was implicitly coordinated, the communications would ideally consist of "lectures",

where information was sent and received in an efficient 2-motion effort. One team member sends, another receives the information. This is consistent with the notion of implicit coordination as described by Kleinman and Serfaty (1989) and Morgan and Bowers (1995). So far this measure has demonstrated internal consistency (coefficient alpha was .75; Hollenbeck 1995, personal communication). Hollenbeck also reported that teams which scored as highly efficient using this measure also completed the decision task faster than teams which scored as poorly coordinated.

Strategic Awareness. Strategic awareness was conceptualized as the degree to which team members were aware of the needs and resources of all team members. Items were developed to assess this knowledge through a questionnaire administered after the task. Items provided the nine cues and asked team members to indicate which cues each team member (a) needed and (b) could measure. This resulted in each team member providing a response for each of the nine cues, for each of the three team members (including self), regarding needs (27 items) and capabilities (what each team member could measure - 27 items).

Team effectiveness. Team effectiveness was conceptualized as team decision accuracy. Measurement was based on the absolute difference between the team's decision and the correct assessment. There were 7 alternatives from which the team had to choose, ranging from very low threat (ignore) to very high threat (defend). Teams earned points depending on how many levels of difference were between their choice and the correct choice. If their decision was exactly correct, the team earned 2 points. If the team was one level off, the team earned 1 point. Two levels off earned 0 points, three levels off and the team lost a point, and four or more levels off resulted in the team losing two points.

Hypotheses

It was expected that the impact of gender configuration on team effectiveness can be accounted for by differences in strategic awareness and communication patterns, and that the impact of strategic awareness and communication patterns on team effectiveness will be mediated by MLT core constructs of team informity, staff validity, and hierarchical sensitivity. If we unpack this statement, we find several sets of hypotheses. Hypotheses were offered with regard

to:

1. The impact of gender-related variables on team performance.
2. The impact of gender-related variables on MLT core constructs.
3. The impact of gender-related variables on communication /strategic awareness.
4. The impact of MLT core constructs on team performance.
5. The mediation of team performance by MLT core constructs.

1. Impact of gender variables on team decision accuracy. Several gender-related variables were expected to affect team decision making performance. The first three hypotheses compare three measures of gender mix as they relate to team decision accuracy. In the past, gender mix has been reported in terms of proportion of females to males, or the comparison of same-sex to mixed-gender teams. In this study it is expected that more detailed specification of gender configuration will provide more accurate understanding of gender effects within teams.

H1. Differences in gender configuration will be associated with differences in team performance. The categorical variable representing the 6 gender configurations were expected to account for significant variance in team decisionmaking performance. This was tested using the General Linear Model to calculate the ANOVA F-test. In addition, specific hypotheses were tested using t-tests.

H1a. All-male teams would perform more accurately than all-female teams

H1b. All-male teams will perform more accurately than teams with a single female.

H1c. All-female teams would perform more accurately than mixed-gender teams.

H1d. All-female teams will perform more accurately than teams with a single female.

H1e. Teams with a single male subordinate will perform more accurately than teams with a single female subordinate .

H1f. Teams with a single male as leader will perform more accurately than teams with a single female as leader.

Exploratory analyses related to H1. H1a-H1f were re-analyzed using two more commonly used indices of gender mix in teams. The first is the proportion of men to women, as indicated by the number of women in a team. The second measure is that of gender diversity, a dichotomous variable indicating whether the team was same-sex or mixed-gender. It will be seen that these

categories were insufficient; results were misleading for some predictions due to the different gender configurations that were categorized together.

Analyses using variable "proportion of women." It was expected that differences in the proportion of men to women will be associated with differences in team performance. This set of hypotheses uses a measure that distinguishes teams on the basis of proportion of women and men in the team. In contrast to the measure used in H1, this measure does not take into account the sex of the leader, or the sex of the minority team member. The same hypotheses were analyzed, if possible. Some hypotheses could not be tested using this variable.

H1Ex1a. All-male teams will perform more accurately than teams with all females.

H1Ex1b. All-male teams will perform more accurately than teams with a single female.

H1Ex1c. All-female teams will perform more accurately than teams with a single female.

These hypotheses were embedded in hypothesis 1. It is noted that any hypothesis which can be formulated regarding the proportion of women to men can be addressed using the gender configuration variable used in hypothesis 1.

Analyses using the variable "gender diversity." Gender diversity (same-sex teams Vs mixed-sex teams) will be associated with differences in team performance. This hypothesis investigates whether previous findings comparing same-sex to mixed-sex teams are replicable here.

H1Ex2a. Teams with all team members of the same sex (i.e. all male or all female) will perform more accurately than mixed-gender teams.

This hypothesis is also embedded in hypothesis 1. It is noted that with this coding scheme, only one comparison can be made. Specificity as to the gender of same-sex teams, the proportion of women to men, the gender of a minority (sole representative of the opposite gender) team member, or the gender of the leader is not available using this measure. All subsequent hypotheses were based on the more specific gender configuration variable.

2. Impact of gender configuration on MLT core constructs. The following hypotheses relate gender configurations to each MLT core construct.

H2a. Differences in gender configuration will be associated with differences in team informity. The categorical variable representing the 6 gender configurations were expected to account for significant variance in team informity. This was tested using the General Linear

Model to calculate the ANOVA F-test. Consistent with MLT theory, it is expected that gender configuration categories associated with higher team performance will demonstrate higher team informity than gender configuration categories associated with poor team performance.

H2b. Differences in gender configuration will be associated with differences in staff validity. The categorical variable representing the 6 gender configurations were expected to account for significant variance in staff validity. This was tested using the General Linear Model to calculate the ANOVA F-test and specific t-tests for each category. Consistent with MLT theory, it was expected that gender configuration categories associated with higher team performance will demonstrate higher staff validity than gender configuration categories associated with poor team performance.

H2c. Differences in gender configuration will be associated with differences in hierarchical sensitivity. The categorical variable representing the 6 gender configurations were expected to account for significant variance in team hierarchical sensitivity. This was tested using the General Linear Model to calculate the ANOVA F-test and specific t-tests for each category. Consistent with MLT theory, it was expected that gender configuration categories associated with higher team performance will demonstrate more effective hierarchical sensitivity than gender configuration categories associated with poor team performance.

3. Impact of gender-related variables on implicit coordination and strategic awareness. Gender configuration is also expected to demonstrate differences in communication patterns and degree to which each team member knows the needs and capabilities of other team members.

H3a. Differences in gender configuration will be associated with differences in implicit coordination. The categorical variable representing the 6 gender configurations were expected to account for significant variance in implicit coordination. This was tested using the General Linear Model to calculate the ANOVA F-test and specific t-tests for each category. Gender configuration categories associated with high team performance were expected to demonstrate more effective implicit coordination than gender configuration categories associated with poor team performance.

H3b. Differences in gender configuration will be associated with differences in strategic awareness. The categorical variable representing the 6 gender configurations were expected to account for significant variance in strategic awareness. This was tested using the General Linear

Model to calculate the ANOVA F-test and specific t-tests for each category. Gender configuration categories associated with high team performance were expected to demonstrate a higher degree of strategic awareness than gender configuration categories associated with poor team performance.

4. Impact of MLT core constructs on team decision accuracy. Four hypotheses test propositions offered by Hollenbeck (1995) regarding the Multi-level theory.

H4a. All else constant, team decision making accuracy will be higher for teams which are high in team informity than for teams which are low in team informity.

H4b. All else constant, team decision making accuracy will be higher for teams which are high in staff validity than for teams which are low in staff validity.

H4c. All else constant, team decision making accuracy will be higher for teams which are high in hierarchical sensitivity than for teams which are low in hierarchical sensitivity.

5. Mediation of team performance by MLT constructs. This tests the proposition offered by Hollenbeck et al., (1995) regarding the multi-level theory of team performance, with regard to the mediation of team performance through the MLT core constructs.

H5. The effect of noncore variables (gender configuration, implicit coordination, strategic awareness) will be mediated by the core constructs. Staff validity, team informity, and hierarchical sensitivity are expected to predict unique variance in team decision effectiveness. This will be tested using multiple regression to ascertain the main effects of these three variables. It was predicted that each MLT core variable will add significantly to the overall R2, and that addition of noncore variables will not contribute significantly to the R2.

H5a. The effect of gender configuration on team decision making accuracy will be mediated by MLT core constructs.

H5b. The effect of implicit coordination on team decision making accuracy will be mediated by MLT core constructs. Implicit coordination is expected to be related to team informity, and to a lessor degree, staff validity. Teams which are efficient in their information transfer activities are expected to be more highly informed than those which are not efficient. Teams that are more highly informed are expected to provide more reliable recommendations, as reflected by staff validity.

H5c. The effect of strategic awareness on team decision making accuracy will be mediated by MLT core constructs.

Results

Reliability of Measures

Strategic Awareness. Strategic awareness was measured by items which asked which cues each team member could measure. Each subject could measure five cues. Of these five cues, four are needed by the other team members. Each of the three team members was asked which of the nine cues each team member could measure, which resulted in 27 items. They were also asked which of the nine cues each team member needed. Cronbach's Alpha was 0.79 for the total measure, 54 items, (SA_ALL) based on raw scores. A factor analysis revealed two factors, which corresponded to items regarding team member needs versus items regarding team member capabilities (i.e. knowledge of what each team member could measure). Cronbach's Alpha for items regarding team member needs (SA_NEEDS) was 0.76; and for items regarding team member capabilities (SA_MEAS) was 0.82. Team members were more accurate in reporting their own needs and capabilities than those of others. (See Appendix for item means, item-total correlations, and factor loadings).

Implicit Coordination. Implicit coordination was measured by a weighted sum of inefficient sequences of dyadic information exchange (#slights + 2# unresponses + 3# forgets + 2#learns), across team members and decisions. Intercorrelations between each item and the total are as follows:

Table 5. Implicit Coordination: Item Intercorrelations and Reliability Indices

	IMP_COOR	SLIGHTS	2_UNRESP	3_FORGETS	2_LEARNS
IMP_COOR	1.00	0.50**	0.84**	0.69**	0.87**
SLIGHTS		1.00	0.41**	0.77**	0.17**
2_UNRESP			1.00	0.49**	0.54**
3_FORGETS				1.00	0.43**
2_LEARNS					1.00

** P < .01

	Raw Variables		Std Variables	
Deleted Variable	Corr w/Tot	A lpha	Corr w/Tot	Alpha
SLIGHTS	0.39	0.64	0.55	0.74
2_UNRESP	0.62	0.38	0.60	0.72
3_FORGETS	0.60	0.58	0.74	0.64
2_LEARNS	0.52	0.57	0.45	0.79

Cronbach Coefficient Alpha for raw variables was 0.63, for standardized variables was 0.78, thus the measure is quite reliable, particularly given it has only four items.

Central Tendency and Correlations

The following table provides measures of central tendency, variability, and correlational statistics for variables analyzed in this study. The p-values equal to or less than 0.10 are marked, in light of the low statistical power associated with the total number of teams analyzed in this study.

Table 6. Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	Max
GEN_DIV	38	0.65	0.48	0	1.00
N_FEMALE	38	1.55	0.98	0	3.00
SEX_LEAD	38	1.50	0.51	1.00	2.00
PERFORM	38	37.78	16.50	-10.00	65.00
SPE_INF	38	0.91	0.11	0.56	1.00
STAFFVAL	38	0.48	0.13	0.20	0.71
HIER_SEN	38	0.17	0.14	0.01	0.67
IMP_COOR	38	194.90	145.68	8.00	535.00
SA_MEAS	38	47.50	9.35	28.00	65.00
SA_NEEDS	38	63.87	6.05	47.00	74.00
SA_ALL	38	111.37	11.04	87.00	132.00

Table 7. Correlations (N = 38)

	G.D.	N.F.	S.L.	PER	S.I.	S.V.	H.S.	I.C.	S.N.	S.M.
GEN_DIV	1.00	-0.05	-0.05	-0.13	-0.32*	-0.29^	-0.11	0.10	-0.10	-0.06
N_FEMALE		1.00	0.52**	-0.35*	-0.23	-0.30^	0.16	0.32*	-0.04	-0.05
SEX_LEAD			1.00	0.06	-0.04	0.06	0.03	-0.02	0.03	0.17
PERFORM				1.00	0.68**	0.51**	-0.62**	-0.38**	0.24	-0.14
SPE_INF					1.00	0.62**	-0.22	-0.56**	0.23	-0.18
STAFFVAL						1.00	-0.01	-0.54**	0.23	-0.01
HIER_SEN							1.00	0.07	0.03	0.28^
IMP_COOR								1.00	-0.11	0.29^
SA_NEEDS									1.00	-0.02
SA_MEAS										1.00

^ Significant at p<0.10>0.05 * Significant at p<0.05>0.01 ** Significant at p<0.01

Gender-related Variables and Team Decision Accuracy

The following set of results demonstrates the need for higher specificity in describing gender configuration of teams. Results from the use of specific categorization (gender configuration measure) used for hypothesis 1 demonstrates that more commonly used, broader descriptions of gender mix, used in hypotheses 2 and 3 can provide misleading results.

H1. Differences in gender configuration will be associated with differences in team decision accuracy. This overall hypothesis was tested using general linear model procedures for an ANOVA F test.

Table 8. Effect of Gender Configuration on Team Decision Accuracy: ANOVA/Regression Analyses

Source	DF	SS	Mean Square	F Value	Pr > F
Model	5	3009.86	601.97	2.72	0.0371
Error	32	7082.45	221.33		
Total	37	10092.32			
R-Square 0.30					

Parameter	Estimate	T-test	Pr	Std Error
INTERCEPT	35.29	6.28	0.0001	5.62
GROUPMMM	12.05	1.46	0.1552	8.28
MMF	9.38	1.13	0.2655	8.28
MFF	8.21	0.99	0.3284	8.28
FMM	-14.14	-1.78	0.0848	7.95
FFM	2.71	0.33	0.7451	8.28
FFF	0.00			

The overall F-test for the effect of gender configuration on team decision accuracy was significant ($p<0.05$). Because this analysis was based on a low number of subjects, the effect size is fairly large ($eta^2 = 0.30$). Mean differences were fairly large, ranging from 21 to 47. Specific comparisons follow. T-tests were performed on these planned comparisons.

<u>H1a</u>. All-male teams would perform more accurately than all-female teams. Not supported. While the all-male teams did have higher mean accuracy than did all-female teams, the difference between the means was not significantly different at $p = 0.05$ ($T = 1.46$).

<u>H1b</u>. All-male teams will perform more accurately than teams with a single female. Not supported. The mean team decision accuracy scores in this comparison was not significantly different at $p = 0.05$.

H1c. All-female teams would perform more accurately than mixed-gender teams. Not supported. The mean team decision accuracy score for all female teams (35.29) was not significantly different from mixed-gender teams (36.20); (T= -0.11).

H1d. All-female teams will perform more accurately than teams with a single female. Not supported. All-female teams performed less accurately.

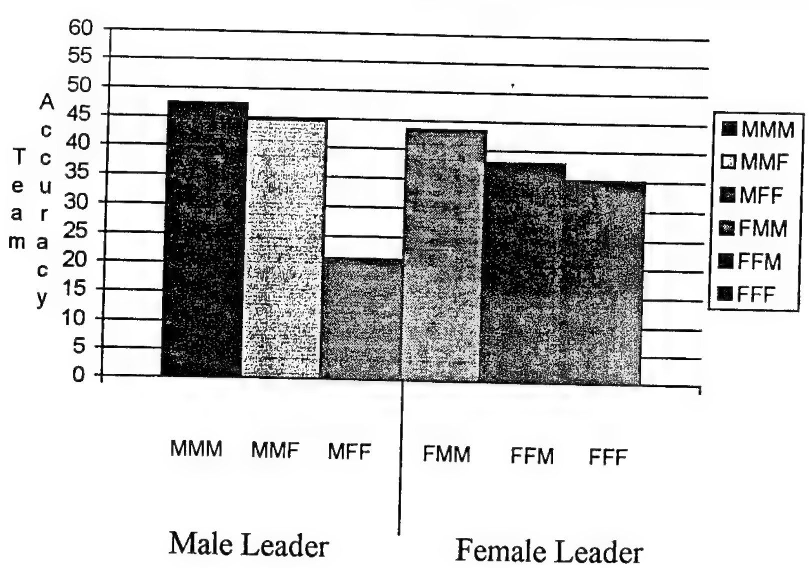
H1e. Teams with a single male subordinate will perform more accurately than teams with a single female subordinate. Not supported. Teams with a single male subordinate performed less accurately (38.00) than teams with a single female subordinate (47.63)

H1f. Teams with a single male as leader will perform more accurately than teams with a single female as leader. Not supported. Teams with a single male as leader performed least accurately of all groups (21.14). Teams with a single female leader performed much more accurately (43.50).

Table 9. Mean Team Decision Accuracy Score for Gender Configuration Groups

Variable	N	Mean	Std .Dev.	Min	Max
MMM	6	47.33	7.28	36.00	55.00
MMF	6	44.67	4.13	39.00	50.00
MFF	7	21.14	18.32	-4.00	49.00
FMM	6	43.50	11.67	26.00	58.00
FFM	6	38.00	17.69	10.00	65.00
FFF	7	35.29	20.30	-10.00	48.00

Figure 3. Mean Team Decisionmaking Accuracy by Gender Configuration



A post-hoc comparison of means (Tukey test) revealed only one comparison which was significant at p = 0.05; that between the highest and lowest mean scores: all-male teams versus teams with a male leader and two female subordinates. While there were mean differences between teams with a male leader versus teams with a female leader, the difference is not statistically significant. Several of the comparisons were consistent with the hypotheses in that mean differences were in the predicted direction.

H1Exp1. Differences in the proportion of men to women will be associated with differences in team decision accuracy. This overall hypothesis was supported. The correlation between number of women and team decision accuracy was -0.35, which was significant at $p \leq 0.05$. However, as noted below, the use of this variable to investigate the effect of gender in teams can be misleading. The correlation would lead one to believe that the worst performing team would be all-female, however that is not the case. A comparison of means between groups reveal that teams with 2 females performed less accurately than all-female teams; however, it does not distinguish between teams where the single male is the leader versus teams where the single male is the subordinate. None of these comparisons were significantly different, the only significant difference captured using the gender configuration variable in hypothesis 1, is not captured here.

Table 10. Proportion of Female/male and Team Decision Accuracy

Variable	N	Mean	Std Dev	Minimum	Maximum
MMM	6	47.33	7.28	36.00	55.00
MMF / FMM	12	44.08	8.37	26.00	58.00
MFF / FFM	13	28.92	19.35	-4.00	65.00
FFF	7	35.29	20.30	-10.00	48.00

One should note that in this set of analyses, the conclusion is that teams with 2 females and one male performed least accurately (28.92). However, in the more specific analyses using gender configuration, it is evident that the group with a male leader and two female subordinates performed least accurately (21.14), and teams with two females where one of the females is the leader performed more accurately (38.00). This demonstrates the inaccuracy that can arise when

using broad categories to represent gender mix rather than more specific approach taken in this study, which further distinguishes groups based on the sex of the leader.

H1Exp2. Gender diversity (same-sex teams vs. mixed-sex teams) will be associated with differences in team decision accuracy, such that teams with all team members of the same sex will perform more accurately than mixed-gender teams. However, the correlation between gender diversity (dichotomous variable) and team decision accuracy was not statistically significant.

Table 11. Gender Diversity and Team Decision Accuracy

Variable	N	Mean	Std .Dev.	Min	Max
0 Same Sex	13	40.85	16.35	-10.00	55.00
1 Mixed Sex	25	36.20	16.71	-4.00	65.00

Using these two broad categories, results indicate no significant difference between same-sex teams and mixed-sex teams. Again, it can be noted that collapsing different gender configurations into broad categories can be misleading. In this case, collapsing across all-male and all-female teams is not appropriate, as all-male teams performed more accurately than all-female teams. Collapsing across all mixed-sex teams prohibits the identification of several significant differences among the different mixed-gender groups. In this case, when using gender diversity as the indicator of gender mix, significant differences were not identified.

Because this analysis demonstrates that the use of "number of women in the team" or "same-sex vs. mixed-sex" as representing gender mix categories can be imprecise and misleading, remaining analyses with regard to the effect of gender configuration will be performed using the more specific gender configuration categories. The effects of "number of women" and "gender diversity" on other variables will be reported in the Appendix. It should be apparent that any effects that can be captured with "number of women" or "gender diversity" were captured in the more specific gender configuration categories and in addition, the gender configuration categories enable more specific predictions to be investigated.

Gender-Related Variables And MLT Core Constructs

H2a. Differences in gender configuration will be associated with differences in team informity. This hypothesis was supported; the overall ANOVA F was 2.13, which was significant

at p= 0.09. Mean differences followed the same pattern as found with team decision accuracy. The gender configuration with the highest team informity was the all-male teams, while the teams with a single male leader (two female subordinates) had the lowest mean team informity.

Table 12. Effect of Gender Configuration on Team Informity: ANOVA/Regression Analyses

Source	DF	SS	Mean Square	F Value	Pr > F
Model	5	0.1140	0.0228	2.13	0.0877
Error	32	0.3431	0.0107		
Total	37	0.4571			

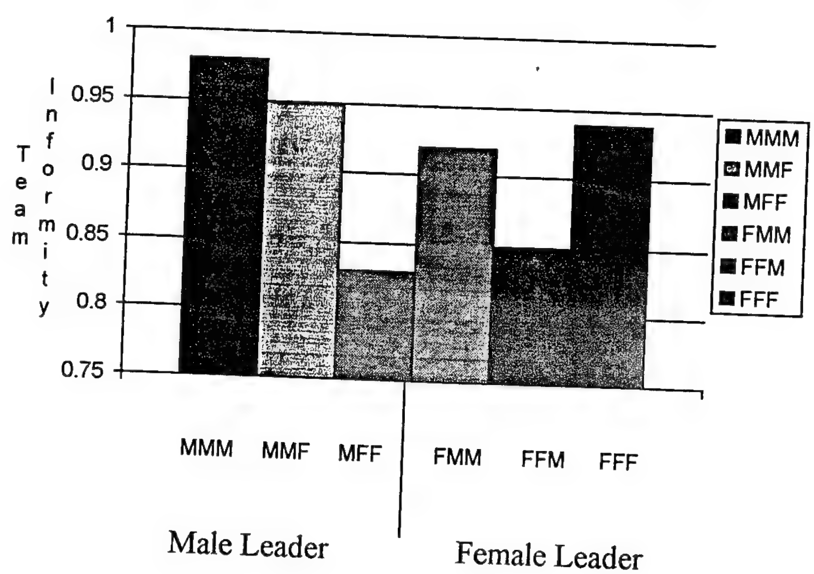
R-Square: 0.249

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error Estimate
INTERCEPT	0.9408 B	24.04	0.0001	0.0391
MMM	0.0395 B	0.69	0.4975	0.0576
MMF	0.0083 B	0.14	0.8863	0.0576
MFF	-0.0237 B	-0.41	0.6829	0.0576
FMM	-0.1137 B	-2.06	0.0481	0.0553
FFM	-0.0885 B	-1.54	0.1341	0.0576
FFF	0.0000 B			

Table 13. Mean Team Informity for each Gender Configuration Group

Variable	N	Mean	Std.Dev.	Min	Max
MMM	6	0.98	0.02	0.94	1.00
MMF	6	0.95	0.03	0.90	0.99
MFF	7	0.83	0.17	0.56	0.98
FMM	6	0.92	0.09	0.77	1.00
FFM	6	0.85	0.13	0.68	1.00
FFF	7	0.94	0.08	0.77	0.99

Figure 4. Mean Team Informity by Gender Configuration



H2b. Differences in gender configuration will be associated with differences in staff validity. This was tested using the General Linear Model to generate the overall F-test for the effect of group on staff validity. The overall F was 2.11, which was significant at $p = 0.09$. Mean differences followed the same pattern as found with team decision accuracy. The gender configuration with the highest team informity was the all-male teams, while the teams with a single male leader (two female subordinates) had the lowest mean team informity.

Table 14. Effect of Gender Configuration on Staff Validity: ANOVA/Regression Analyses

Source	DF	SS	Mean Square	F Value	Pr > F
Model	5	0.1513	0.0303	2.11	0.0903
Error	32	0.4597	0.0144		
Total	37	0.6111			

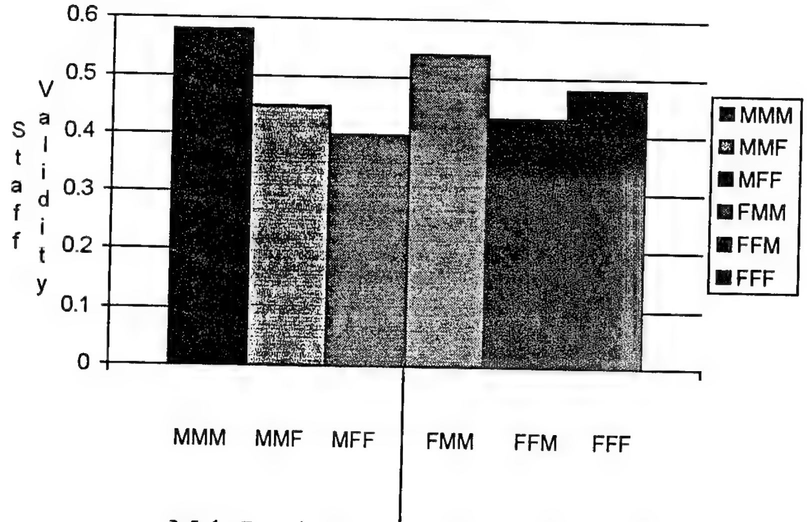
R-Square 0.2476

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error Estimate
INTERCEPT	0.4829285714 B	10.66	0.0001	0.04530378
MMM	0.0974880952 B	1.46	0.1535	0.06668537
MMF	-.0367119048 B	-0.55	0.5858	0.06668537
FMM	0.0569547619 B	0.85	0.3994	0.06668537
MFF	-.0868857143 B	-1.36	0.1846	0.06406923
FFM	-.0499285714 B	-0.75	0.4595	0.06668537
FFF	0.0000000000 B			

Table 15. Mean Staff Validity by Gender Configuration: ANOVA/Regression Analyses

Variable	N	Mean	Std Dev	Min	Max
MMM	6	0.58	0.14	0.36	0.71
MMF	6	0.45	0.10	0.33	0.55
MFF	7	0.40	0.12	0.20	0.51
FMM	6	0.54	0.14	0.31	0.70
FFM	6	0.43	0.11	0.26	0.56
FFF	7	0.48	0.11	0.30	0.62

Figure 5. Mean Staff Validity by Gender Configuration



H2c. Differences in gender configuration will be associated with differences in hierarchical sensitivity. Not supported. The F-Test was not significant.

Table 16. Effect of Gender Configuration on Hierarchical Sensitivity: ANOVA/Regression Analyses

Source	DF	SS	Mean Square	F Value	Pr > F
Model	5	0.0602	0.0120	0.58	0.7146
Error	32	0.6632	0.0207		
Total	37	0.7234			

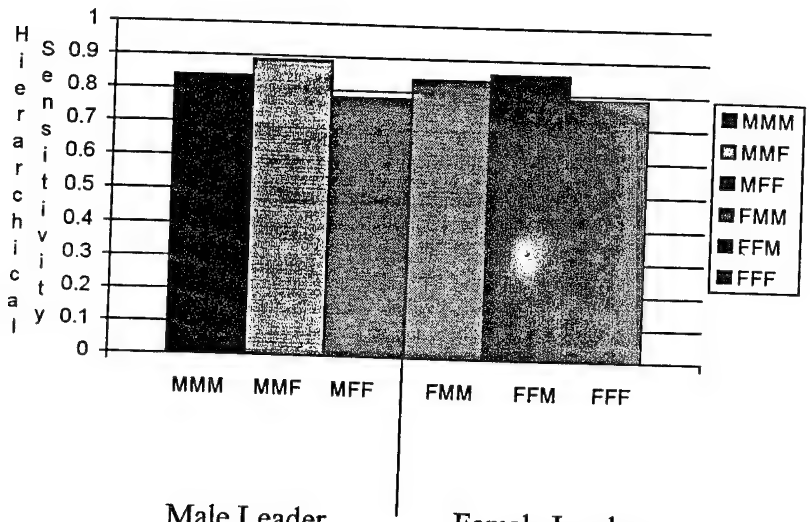
R-Square 0.0831

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error Estimate
INTERCEPT	0.2131	3.92	0.0004	0.0544
MMM	-0.0522	-0.65	0.5190	0.0801
MMF	-0.1057	-1.32	0.1964	0.0801
FMM	-0.0541	-0.68	0.5041	0.0801
MFF	0.0044	0.06	0.9549	0.0770
FFM	-0.0766	-0.96	0.3457	0.0801
FFF	0.0000	.	.	.

Table 17. Mean Hierarchical Sensitivity by Gender Configuration

Condition	Variable	N	Mean	Std Dev	Min	Max
MMM	HIER_SEN	6	0.16	0.10	0.03	0.29
MMF	HIER_SEN	6	0.11	0.07	0.05	0.24
MFF	HIER_SEN	7	0.22	0.14	0.08	0.51
FMM	HIER_SEN	6	0.16	0.09	0.06	0.30
FFM	HIER_SEN	6	0.14	0.18	0.00	0.48
FFF	HIER_SEN	7	0.21	0.21	0.03	0.67

Figure 6. Mean Hierarchical Sensitivity by Gender Configuration



Note: The hierarchical sensitivity score is based on the difference between leader weighting of subordinate recommendations and ideal weights. As such, the higher the score, the lower the sensitivity of the leader. For the bar graph, all scores were subtracted from 1 so that higher scores would indicate higher sensitivity.

Gender Configuration and Implicit Coordination / Strategic Awareness

H3a. Differences in gender configuration will be associated with differences in implicit coordination. While mean differences can be observed to follow the same pattern as results with other performance measures, the difference is not statistically significant.

Table 18. Effect of Gender Configuration on Implicit Coordination: ANOVA/Regression Analyses

Source	DF	SS	MSquare	F Value	Pr > F
Model	5	155811.18	31162.24	1.58	0.1928
Error	32	629490.71	19671.58		
Total	37	785301.89			

R-Square 0.1984

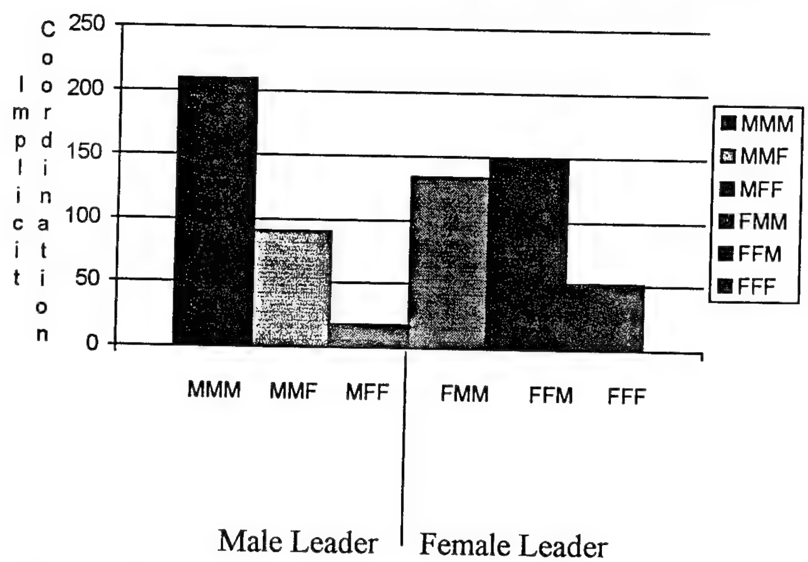
Parameter	Estimate	T for H0: Para=0	Pr > |T|	Std Error Estimate
INTERCEPT	247.8571	4.68	0.0001	53.0115
MMM	-157.357	-2.02	0.0522	78.0309
MMF	-38.5238	-0.49	0.6249	78.0309
FMM	-82.1904	-1.05	0.3001	78.0309
MFF	34.0000	0.45	0.6532	74.9696
FFM	-96.6904	-1.24	0.2243	78.0309
FFF	0.00000			

Table 19. Mean Implicit Coordination for Gender Coordination Groups

	Variable	N	Mean	Std. Dev.	Min	Max
MMM	IMP_COOR	6	90.50	68.03	21.00	209.00
MMF	IMP_COOR	6	209.33	161.64	111.00	535.00
MFF	IMP_COOR	7	281.86	194.62	41.00	502.00
FMM	IMP_COOR	6	165.67	145.83	26.00	449 .00
FFM	IMP_COOR	6	151.17	131.82	8.00	393.00
FFF	IMP_COOR	7	247.86	95.95	95.00	343.00

NOTE: The higher the implicit coordination score the lower the efficiency, (based on # inefficiencies). However, in the bar graph below the scale was reversed by subtracting each score from 300.

Figure 7. Implicit Coordination* by Gender Configuration



* The measure of implicit coordination is based on the number of "wasted motions" emitted by each team; therefore the actual scale is such that a larger number is more inefficient. However, for this graph, each score was subtracted from 300 in order to indicated increased coordination with a higher score. Thus, graphs can be easily compared to note the similarity in team performance profiles across criteria.

<u>H3b</u>. Differences in gender configuration will be associated with differences in strategic awareness. It was predicted that gender configuration would affect strategic awareness; however, the ANOVA analysis F test was not significant.

Table 20. **Effect of Gender Configuration on Strategic Awareness: ANOVA/Regression Analyses**

Source	DF	SS	Mean Square	F Value	Pr > F
Model	5	400.59	80.12	0.90	0.49
Error	32	2834.90	88.59		
Total	37	3235.50			

R-Square 0.12

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error Estimate
INTERCEPT	49.43	13.89	0.0001	3.56
MMM	-2.43	-0.46	0.6459	5.24
MMF	0.07	0.01	0.9892	5.24
FMM	2.40	0.46	0.6492	5.24
MFF	-7.57	-1.50	0.1421	5.03
FFM	-3.43	-0.65	0.5173	5.24
FFF	0.00			

Table 21. Mean Strategic Awareness for each Gender Configuration

	N	Mean	Std. Dev.	Min	Max
MMM	6	64.67	3.33	61.00	70.00
MMF	6	63.33	9.79	47.00	72.00
MFF	7	63.14	7.03	49.00	68.00
FMM	6	65.17	2.64	62.00	69.00
FFM	6	62.17	6.74	52.00	71.00
FFF	7	64.71	6.02	54.00	74.00

MLT Core Constructs And Team Decision Accuracy

The next three hypotheses were tested using correlations, general linear model regression and ANOVA statistics. Results were consistent with MLT theoretical propositions.

H4a. All else constant, team decision making accuracy will be higher for teams which are high in team informity than for teams which are low in team informity. Results were consistent with this hypothesis; the Pearson correlation ($r = 0.68$) was significant at $p \leq 0.01$).

H4b. All else constant, team decision making accuracy will be higher for teams which are high in staff validity than for teams which are low in staff validity. Results were consistent with this hypothesis; the Pearson correlation ($r = 0.51$) was significant at $p \leq 0.01$).

H4c. All else constant, team decision making accuracy will be higher for teams high in hierarchical sensitivity than for teams low in hierarchical sensitivity. Results were consistent with this hypothesis; the Pearson correlation (r = -0.62) was significant at p </= 0.01).

The three MLT constructs should account for unique variance in the prediction of team decision accuracy, demonstrated by simultaneous regression analysis.

Table 22. MLT Core Constructs and Team Decision Accuracy: ANOVA/Regression Analyses

Source	DF	SS	MS	F	Prob F	
Model	3	7431.41	2477.14	31.65	0.00	
Error	34	2660.91	78.26			
Total	37	10092.31				
$R^2 = 0.73$						
Variable	DF	Para Estimate	Std Error	T	Pr T	Std Estimate
Intercept	1	-22.57	13.21	-1.71	0.09	0.00
Team_Inf	1	60.89	17.28	3.52	0.00	0.41
Staff_Val	1	32.40	14.58	2.22	0.03	0.25
Hier_Sen	1	-62.38	10.81	-5.77	0.00	-0.53

Results support hypotheses that team informity, staff validity, and hierarchical sensitivity each contribute to the prediction of team decision accuracy. In addition, the three variables together account for 73 percent of the variance in decision accuracy. The following table displays mean differences in decision accuracy as a function of low versus high values on team informity, staff validity, and hierarchical sensitivity.

Table 23. Team Decision Accuracy By Three Levels Of Team Informity (RTI)

RTI	N	Mean	Std .Dev.	Min	Max
0 Low informity	12	22.00	17.38	-10.00	43.00
1 Mod informity	14	44.36	11.29	10.00	58.00
2 High informity	12	45.92	8.12	36.00	65.00

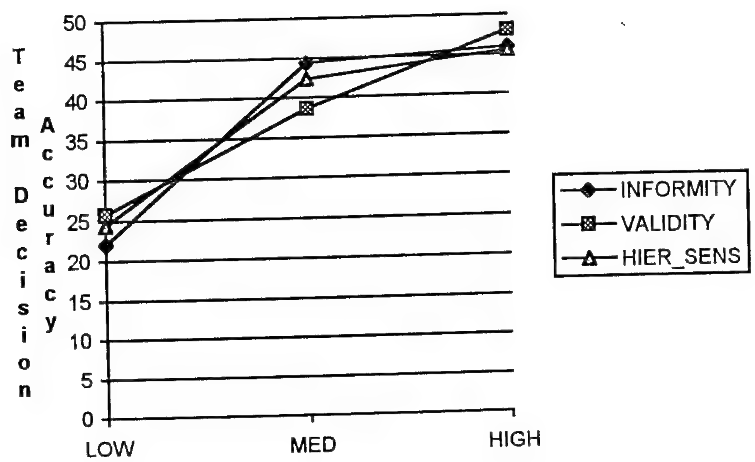
Table 24. Team Decision Accuracy By Three Levels Of Staff Validity (RSV)

RSV	N	Mean	Std .Dev.	Min	Max
0 Low staff val	12	25.75	19.79	-10.00	50.00
1 Mod staff val	13	38.62	12.30	10.00	51.00
2 High staff val	13	48.08	8.39	36.00	65.00

Table 25. Team Decision Accuracy By Three Levels Of Hierarchical Sensitivity (RHS)

RHS	N	Mean	Std. Dev.	Min	Max
0 Low H.S.	12	24.42	20.07	-10.00	50.00
1 Mod H.S.	13	42.38	11.71	10.00	55.00
2 High H.S.	13	45.54	8.25	35.00	65.00

Figure 8. Mean Team Decision Accuracy Associated With Levels Of MLT Constructs



The next hypothesis tests the proposition offered by Hollenbeck et al., (1995) regarding the multi-level theory of team performance, with regard to the mediation of team performance through the MLT core constructs.

H5. The effect of noncore variables (gender configuration, implicit coordination, strategic awareness) will be mediated by the core constructs. Staff validity, team informity, and hierarchical sensitivity are expected to predict unique variance in team decision effectiveness. This will be tested using multiple regression to ascertain the main effects of these three variables. It was predicted that each MLT core variable will add significantly to the overall R2, and that addition of noncore variables will not contribute significantly to the R2.

H5a. The effect of gender configuration on team decision making accuracy will be mediated by MLT core constructs.

Table 26. Mediation Of Gender Configuration: ANOVA/Regression Analyses

Source	DF	SS	MeanSq	F Value	Pr > F
Model	8	7891.47	986.433	13.00	0.0001
Error	29	2200.84	75.891		
Total	37	10092.32			

R-Square 0.78

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error Estimate
INTERCEPT	-19.8084	-1.27	0.2150	15.6256
SPE_INF	58.7445	3.15	0.0038	18.6615
STAFFVAL	24.5898	1.56	0.1294	15.7541
HIER_SEN	-56.5475	-5.10	0.0001	11.0979
MMM	4.3749	0.87	0.3932	5.0480
MMF	3.8205	0.76	0.4511	5.0008
FMM	5.1484	1.02	0.3176	5.0627
MFF	-5.0749	-1.02	0.3154	4.9669
FFM	4.8091	0.93	0.3587	5.1563
FFF	0.0000			

<u>H6b</u>. The effect of implicit coordination on team decision making accuracy will be mediated by MLT core constructs. The test of mediation using multiple regression was consistent with the hypothesis. Implicit coordination did not add significant amount of variance accounted for after consideration of MLT core constructs.

Table 27. Mediation of Implicit Coordination by MLT constructs

Source	DF	Sum/Sq	MSquare	F Value	Prob>F
Model	4	7442.30	1860.57551	23.169	0.0001
Error	33	2650.01	80.30345		
C Total	37	10092.32			

R-square 0.74

Variable	DF	Estimate	Std Error	T for H0: Para=0	Prob > |T|	Std Estimate
INTERCEPT	1	-26.42	16.97	-1.557	0.1290	0.000
SPE_INF	1	63.2	18.60	3.398	0.0018	0.425
STAFFVAL	1	34.07	15.45	2.205	0.0345	0.265
HIER_SEN	1	-62.30	10.95	-5.688	0.0001	-0.527
IMP_COOR	1	0.00	0.013	0.368	0.7150	0.041

Relationship between implicit coordination and team informity. Teams that have higher implicit coordination were found to have higher team informity than teams with low implicit coordination. The correlation between team informity and implicit coordination was -0.56; significant at p</= 0.01. This indicates the more efficient the coordination, the higher the team informity. The measure of implicit coordination is scaled such that the higher the number (of ineffciencies) the lower the degree of implicit coordination.

Relationship between implicit coordination and staff validity. Teams that have higher implicit coordination were also found to have higher staff validity than teams with low implicit coordination. The correlation between implicit coordination and staff validity was -0.56 (p</= 0.01). This indicates the more coordinated the team, the higher the staff validity. However, this is probably due to the higher informity associated with coordination. To determine this, the next analysis investigates the degree to which the relationship between coordination and validity is mediated by team informity.

Mediation of implicit coordination by team informity for predicting staff validity. The R-square for the prediction of staff validity with informity as the single predictor was 0.38 (Adj = 0.36). The R-square for the prediction of staff validity with efficiency as the single predictor was 0.29 (Adj = 0.27). However, when the two predictors are within a regression model together, the R-square was 0.40 (Adj = 0.37). As predicted, the effect of efficiency on staff validity was mediated by team informity.

Mediation of strategic awareness by communication efficiency for prediction of team informity. Strategic awareness was not significantly related to informity, nor did it contribute to the prediction of informity when added to efficiency. This was expected once the correlations were examined, and strategic awareness was not significantly correlated with any variable of interest.

Trends in performance: Initial versus final performance. The following correlations were calculated on the first 24 decisions made by the team, versus the last 24 decisions.

Table 28. Intercorrelations: 1st Vs. 2nd Half of Session

First Half: First 24 decisions

	G.D.	N.F.	S.L.	P.E.	S.I.	S.V.	H.S.	I.C.	S.N.	S.M.
N_FEMALE		1.00	0.52**	-0.37*	-0.24	-0.36*	0.24	0.33*	-0.04	-0.05
SEX_LEAD			1.00	0.12	-0.02	0.02	0.09	0.05	0.03	0.17
PERFORM				1.00	0.74**	0.58**	-0.42**	-0.32	0.25	-0.0
SPE _INF					1.00	0.58**	-0.22	-0.45**	0.20	-0.17
STAFFVAL						1.00	-0.02	-0.45**	0.20	-0.10
HIER_SEN							1.00	0.10	-0.06	0.23
IMP_COOR								1.00	-0.03	0.33*
SA_NEEDS									1.00	-0.02
SA_MEAS										1.00

Second Half (Last 24 decisions)

	G.D.	N.F.	S.L.	P.E.	S.I.	S.V.	H.S.	I.C.	S.N.	S.M.
N_FEMALE		1.00	0.51**	-0.26	-0.17	-0.08	0.04	0.27	-0.04	-0.05
SEX_LEAD			1.00	-0.03	-0.06	0.02	-0.15	-0.11	0.03	0.18
PERFORM				1.00	0.48**	0.24	-0.34*	-0.34*	0.18	-0.18
SPE_INF					1.00	0.41**	-0.10	-0.62**	0.26	-0.18
STAFFVAL						1.00	-0.16	-0.39**	0.01	0.11
HIER_SEN							1.00	0.17	-0.29	0.20
IMP_COOR								1.00	-0.19	0.19
SA_NEEDS									1.00	-0.02
SA_MEAS										1.00

It is reasonable to expect the construct implicit coordination may make more of an impact as the subjects become more experienced, and have developed a strategy for implicit coordination. To investigate this, correlations were calculated using the first 24 decisions made by the teams, versus the last 24 decisions. The correlations between implicit coordination and performance variables were higher for the second half of the task session. The correlation between implicit coordination and informity increased from 0.45 to 0.62

Discussion

This report described the data collection and analysis of team performance data of three-member teams composed of various configurations of gender of team members and leaders. It was argued that the impact of gender configuration on team performance can be a function of gender differences in communication patterns when the team task requires team members to communicate and strategize to manage their interdependencies and optimize decision making.

Predictions with regard to the impact of gender configuration and communication patterns on team process and outcome were generated within the context of the multi-level theory (MLT) of team performance for hierarchical teams with distributed expertise (Hollenbeck, et al., 1995). According to MLT theory, the effects of exogenous variables, such as individual differences, task characteristics, social roles, etc., on team performance can be explained by their impact on three core variables. These three variables consist of (a) team informity, the degree to which individuals attained requisite information for their decisions, (b) staff validity, the degree to which individuals made reliable judgments, and (c) hierarchical sensitivity, the degree to which the team leader effectively weighted the recommendations of the team members.

Identification of core constructs proximal to and mediating team performance allows systematic investigation of the effect of variables of interest on team performance. It also identifies the manner in which a noncore variable impacts performance. Systematic investigation of each of these core constructs can provide descriptive and diagnostic information. If team informity is lower than average for a task, team members are not coordinating information exchange in an efficient manner, relative to other teams. On the other hand, if staff validity is low, team members are not accurately interpreting information. If hierarchical sensitivity is low, the team leader is not effectively utilizing the capabilities of his/her team members. Identification of the effect of a particular variable on each of these constructs provides more detailed and diagnostic information regarding the impact of a variable on team processes as well as team outcomes.

In this study, it was predicted that gender configuration would be associated with differences in team decision accuracy. Previous studies have demonstrated relationships between gender mix of teams and team performance, with mixed results. This may be due to different measures of gender configuration, use of different team tasks, and/or use of different performance

criteria. In addition, even if results were consistent, demonstration of a consistent relationship between gender mix and performance does not explain the nature of the relationship. Different explanations may be generated. For example, if mixed-gender teams performed less accurately, it could be due to (a) women being less competent (reflected in staff validity), (b) less effective communication and coordination (reflected in team informity), or (c) gender bias in leader decisionmaking (reflected in hierarchical sensitivity). Examination of performance on core constructs enables more detailed information as to how differences in gender configuration impact team performance.

Results were generally consistent with predictions. As predicted, gender configuration was associated with differences in team decision accuracy. The highest performing teams were all-male, while the lowest performing teams were composed of a male leader and two female subordinates. The differences among the gender configuration were quite large, with the highest performing category having a mean performance score over twice as large as the lowest performing category.

It was also demonstrated that differences in performance were explained through the relationship of gender configuration to the MLT core variables. There was no relationship between gender configuration and team decision accuracy after partialing out the effects of MLT core variables. Analyses revealed that gender configuration was significantly related to team informity and to a lessor degree, staff validity. There was no relationship between gender configuration and hierarchical sensitivity.

The relationships between gender configuration and MLT core variables indicate that the effects of gender configuration on team decision accuracy is mainly due to team members not acquiring the information needed for decisionmaking. This suggests that team members were not efficiently communicating and coordinating information exchange. The relationship between gender configuration and staff validity indicates that team members in low-performing gender configurations were making less accurate recommendations to the team leader. This is probably due to those team members not acquiring the information needed to make accurate decisions. Further analyses demonstrated this was so, as there was no relationship between gender configuration and staff validity after controlling for team informity.

While gender configuration was demonstrated as affecting team processes and performance, the hypotheses regarding specific gender configurations were not supported. Several reasons can be offered as to why predictions were not supported. First, predictions were not based on a strong theoretical or empirical foundation, and previous studies reported contradictory results. This could be due to differences in the way gender configuration was measured or differences in the type of team task used in different studies.

It was demonstrated in this study that different measures of gender configuration can provide conflicting results with regard to effects on performance. Previous studies measured gender configuration by assessing the proportion of men to women in the team, or by comparing same-sex teams with mixed gender teams. In this study, results using these variables were compared to a more specific measure of gender configuration that considers not only the proportion of women to men in a team but also the gender of the team leader, such that each unique gender configuration was examined separately. Results revealed that the more traditional measures of gender configuration provided misleading results, because the measures combined gender configurations which have different relationships to team performance. For example, proportion of men to women indicated a negative relationship between number of women in a team and team performance. However, more specific comparisons revealed that the lowest performing team was not the all-female team, but the team with a male leader and two female subordinates. When there are two women in the team, and one is the team leader, the team performed much more accurately. When these two categories are combined (both having two women in the team), this distinction in performance is lost.

The analyses with regard to different measures of gender configuration indicate that the conflicting results from previous studies may be due to how gender configuration was measured. More consistent results may be demonstrated if previous studies are reanalyzed, using a more specific measure of gender configuration. In addition, differences in the type of team task performed by subjects should also be reported. A meta-analytic approach to reanalysis of previous study results may provide more consistent results and greater understanding of the manner in which gender configuration can affect team performance.

While results of this study demonstrated significant effects of gender configuration on implicit coordination, team informity, staff validity, and team decision accuracy, we must consider

limitations to the generalizability of these results. First, the type of team task is a boundary condition for generalization. This task was based on systematic consideration of objective information, where a single correct answer can be calculated, as opposed to a task that includes subjective elements and no clear right answer, such as when a committee must make a policy decision that involves values, ethics, and other subjective elements. The team structure was such that team members had distributed expertise, increasing the probability of conflicting recommendations. The final decision was made by the team leader, as opposed to a consensus process. Effects of gender configuration may be different for other types of team tasks, such as those requiring persuasion, negotiation, and/or consensus.

In addition, this team task was of short term duration. Team members were recruited for this study and had no involvement prior to or after the task performance session. It may be that effects of gender configuration are ameliorated over time, as team members gain more awareness of the competencies of their fellow teammates. On the other hand, it can be argued that effects of gender configuration may instead increase over time. When team members do not know each other, they can be more formal and polite in their interactions. As levels of familiarity increase, team members may be more inclined to reveal gender biases. Conflicts due to gender differences may escalate over time. Generally, the study of team performance and team dynamics within teams over time is not extensive, therefore there is not a lot of empirical data regarding the formulation and maintenance of team cohesiveness, team morale, or team performance. Further study is necessary to trace the impact of gender configuration within teams over time.

The statistical power of analyses in this study was fairly low due to the low number of teams (N = 37 teams). Some of the results were consistent with predictions, in that differences were in the predicted direction. When the number of data points is low, effect sizes must be much larger to demonstrate statistical significance. A larger number of teams may provide the statistical power to support some of the hypotheses that had statistically insignificant differences. On the other hand, many hypotheses were supported, in spite of low power, due to large effect sizes. This indicates that the effect of gender configuration on team performance was large enough to be demonstrated in spite of low statistical power, therefore this study is a conservative estimate of the effect of gender configuration.

In conclusion, this study demonstrated that gender configuration had a significant effect on team communication efficiency, team informity, staff validity, and team decision accuracy, on an objective task that requires very little persuasion, consensus, or consideration of subjective information. The examination of team process measures allowed further information as to the manner in which gender configuration affected team performance. Analyses traced the impact of gender configuration on team performance as due to differences in communication and coordination of information, which in turn affected team informity and staff validity, and thus affected team decision accuracy.

It was also demonstrated that commonly used measures to indicate gender mix can generate misleading results due to overly general categories. Here it was shown that more detailed specification of gender mix, including gender of the team leader, revealed differences that were not captured using the more general categories. Existing data from previous studies should be revisited if these more specific categories can be generated. A meta-analytic approach using more specific gender configuration measures and using the type of team task as a moderator variable may serve to reconcile inconsistent results reported in previous studies.

This study also tested propositions inherent in the MLT theory of performance of hierarchical teams with distributed expertise. Propositions from the MLT theory were fully supported. The MLT core constructs mediated the effect of gender configuration and coordination effectiveness on team decision accuracy. Analyses based on this framework allowed the identification of the manner in which gender configuration affected team performance. This demonstrates the usefulness of theory-driven research, and MLT constructs as a framework for predictions and analysis of data.

While results are not based on operational teams, preliminary investigations using more cost effective and highly configurable synthetic tasks serves to identify relationships that should be further investigated in high-fidelity simulation exercises. Data from this study will drive investigation of the effect of gender configuration in realistic command and control scenarios using operational Airborne Warning and Control System (AWACS) weapons directors. Further study will assess the degree to which AWACS task performance is affected by gender configuration. The effect of gender configuration will be assessed along with team member status as indicated by rank. An interaction is expected between gender and rank, such that female

team members of low rank will be more susceptible to effects of gender differences/biases (i.e. less involvement in team communication and coordination patterns and in addition, lower influence in resource allocation decisions) compared to male team members of high rank.

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Appendix

Analyses using "number of women" and "gender diversity" to represent gender mix.

Analyses using "number of women in team"

Impact on team informity. The number of females in each group was not significantly correlated with team informity ($r = -0.23$).

Variable	N	Mean	Std Dev	Minimum	Maximum
0 SPE_INF	6	0.98	0.02	0.94	1.00
1 SPE_INF	12	0.93	0.07	0.77	1.00
2 SPE_INF	13	0.84	0.15	0.56	1.00
3 SPE_INF	7	0.94	0.08	0.77	0.99

Impact on staff validity. The number of females in each team was significantly correlated with staff validity ($r = -0.30$; $p \leq 0.10$), such that the higher the number of females in the team, the lower the staff validity .

Variable	N	Mean	Std Dev	Minimum	Maximum
0 STAFFVAL	6	0.58	0.14	0.36	0.71
1 STAFFVAL	12	0.49	0.12	0.31	0.70
2 STAFFVAL	13	0.41	0.11	0.20	0.56
3 STAFFVAL	7	0.48	0.11	0.30	0.62

Impact on hierarchical sensitivity

Variable	N	Mean	Std Dev	Minimum	Maximum
0 HIER_SEN	6	0.16	0.10	0.03	0.29
1 HIER_SEN	12	0.13	0.08	0.05	0.30
2 HIER_SEN	13	0.18	0.16	0.00	0.51
3 HIER_SEN	7	0.21	0.21	0.03	0.67

Impact on implict coordination. The number of females in each team was significantly correlated with implicit correlation ($r = 0.32$; $p \leq 0.05$), such that a higher number of females was associated with a higher amount of inefficiencies.

Variable	N	Mean	Std Dev	Minimum	Maximum
0 IMP_COOR	6	90.50	68.03	21.00	209.00
1 IMP_COOR	12	187.50	148.54	26.00	535.00
2 IMP_COOR	13	221.54	175.43	8.00	502.00
3 IMP_COOR	7	247.86	95.95	95.00	343.00

Impact on strategic awareness. The number of women in each team was not significantly correlated with strategic awareness indices.

Mediation by MLT core constructs. The following table provides the multiple regression results for the prediction of team decision accuracy using the MLT core constructs and the number of women. The MLT core constructs mediated the effect of number of women on team decision accuracy .

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	4	7531.16163	1882.79041	24.259	0.0001
Error	33	2561.15416	77.61073		
C Total	37	10092.31579			

R-square 0.7462

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|	Standardized Estimate
INTERCEP	1	-18.057442	13.74	-1.314	0.1979	0.00000000
SPE_INF	1	60.641031	17.21	3.524	0.0013	0.40810051
STAFFVAL	1	28.520209	14.91	1.912	0.0645	0.22191996
HIER_SEN	1	-60.428358	10.90	-5.543	0.0001	-0.51160030
N_FEMALE	1	-1.783382	1.57	-1.134	0.2651	-0.10561321

Analyses using "gender diversity"

Impact on team informity. Gender diversity was significantly correlated with team informity (r = -0.32; p </= 0.05)

Variable	N	Mean	Std Dev	Minimum	Maximum
0 SPE_INF	13	0.96	0.06	0.77	1.00
1 SPE_INF	25	0.88	0.12	0.56	1.00

Impact on staff validity. Gender diversity was significantly correlated with staff validity (r = -0.29; p </= 0.10)

Variable	N	Mean	Std Dev	Minimum	Maximum
0 STAFFVAL	13	0.53	0.13	0.30	0.71
1 STAFFVAL	25	0.45	0.12	0.20	0.70

Impact on hierarchical sensitivity

Variable	N	Mean	Std Dev	Minimum	Maximum
0 HIER_SEN	13	0.19	0.17	0.03	0.67
1 HIER_SEN	25	0.16	0.13	0.00	0.51

Impact on implicit coordination. Gender diversity was not significantly correlated with implicit coordination.

Variable	N	Mean	Std Dev	Minimum	Maximum
0 IMP_COOR	13	175.23	114.88	21.00	343.00
1 IMP_COOR	25	205.20	160.63	8.00	535.00

Impact on strategic awareness. It was expected that gender diversity would have a direct relationship with communication efficiency, and an indirect effect through its impact on strategic awareness. However, gender diversity was not significantly correlated with strategic awareness.